

BELLCOMM, INC.

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B70 09042

SUBJECT: SPS Requirements for a J2
Tycho Mission - Case 310

DATE: September 17, 1970

FROM: M. K. Baker

MEMORANDUM FOR FILE

Non-free return missions to Tycho are possible January through April, 1972. With a translunar abort constraint imposed, missions employing three-burn lunar orbit insertion are feasible for January through March 1972 if both LM descent (DPS) and ascent (APS) propulsion systems are used for abort and an early return is employed in the event of a LM rescue. Three-burn Tycho missions constrained to use only the descent propulsion system for abort are not possible in the J2 time frame.

Optimum three-burn missions were targeted subject to either a DPS or a DPS + APS abort constraint. The one-burn trajectories were all non-free return. Returns from lunar orbit to earth at both 72 hours and 8 hours after rendezvous were examined for all missions considered. The weight model and mission independent ΔV s used for the missions and the assumptions used to generate the trajectories are summarized in the Appendix.

The SPS contingency ΔV available for each mission is shown in the Figure 1. One-burn non-free return missions are feasible for all four months. DPS + APS abortable three-burn missions would be possible for January through March since an early return would allow enough ΔV for a LM rescue. If a LM rescue were not necessary the 300 fps contingency ΔV available is probably sufficient for weather avoidance requirements. The three-burn DPS abortable missions have negative SPS margins during the months considered for return to earth 72 hours after rendezvous. LM rescue would not be possible even if a return 8 hours after rendezvous were used.

M. K. Baker

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2013-MKB-slr

Attachments

(NASA-CR-113677) SPS REQUIREMENTS FOR A J2
TYCHO MISSION (Bellcomm, Inc.) 5 p

N79-71666

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FF No. 6

CR-113677
(NASA CR OR TMX OR AD NUMBER)

(CATEGORY)

APPENDIX

Mission Design Parameters

- Non-free return one-burn LOI trajectories
- Three-burn LOI trajectories subject to either DPS or DPS + APS abort constraint
- The three-burn LOI maneuver employed consists of: (1) a coplanar transfer from a hyperbola to an ellipse, (2) an energy and plane change to a second ellipse, (3) an energy and plane change to a circular parking orbit
- Perilune altitude of all orbits is ≥ 40 nm.
- The circular parking orbit altitude is 60 nm.
- The apolune of the first ellipse is 12,000 nm.
- All missions use Pacific injection
- The launch azimuth is 72 degrees
- There are 24 hrs in lunar orbit from LOI to SPS descent orbit insertion
- The CSM takes the LM down to an altitude of 50,000 ft
- 54 hr surface stay
- $60 \text{ hr} \leq \text{transearth flight time} \leq 110 \text{ hr}$
- The return geographic inclination is < 40 degrees
- $-35 \text{ degrees} \leq \text{earth landing latitude} \leq 35 \text{ degrees}$
- $-170 \text{ degrees} \leq \text{earth landing longitude} \leq -150 \text{ degrees}$
(Pacific zone)
- Maximum mission duration of 15 days

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1	2	3	4	5	6	7	8	9
---		Translunar Midcourse = 32.9	LOI Plus *C.C=80 Plus DOI=75	---	Circularization = 75	CSM Plane Change	LM Rescue = 600	TEI + *C.C=90

SPS ISP = 313.9
LM ISP = 303.25

Fuel Usable	=	39,410
CSM Inert	=	27,490
SLA	=	4,100
LM	=	<u>36,300</u>
Injected Weight		107,300

*Conic Calibration

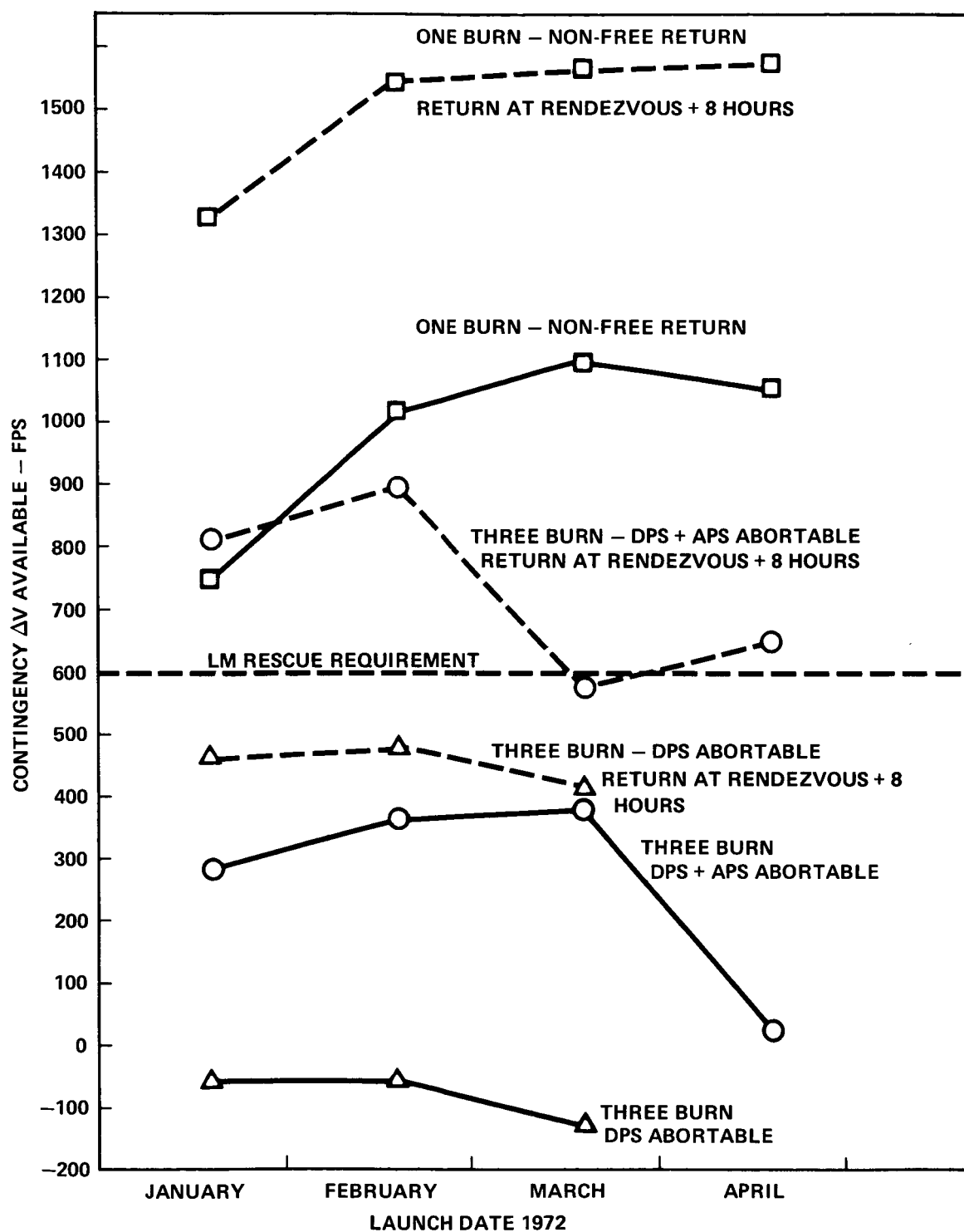


FIGURE 1 - CONTINGENCY ΔV AVAILABLE FOR A MISSION TO TYCHO JANUARY - APRIL 1972

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